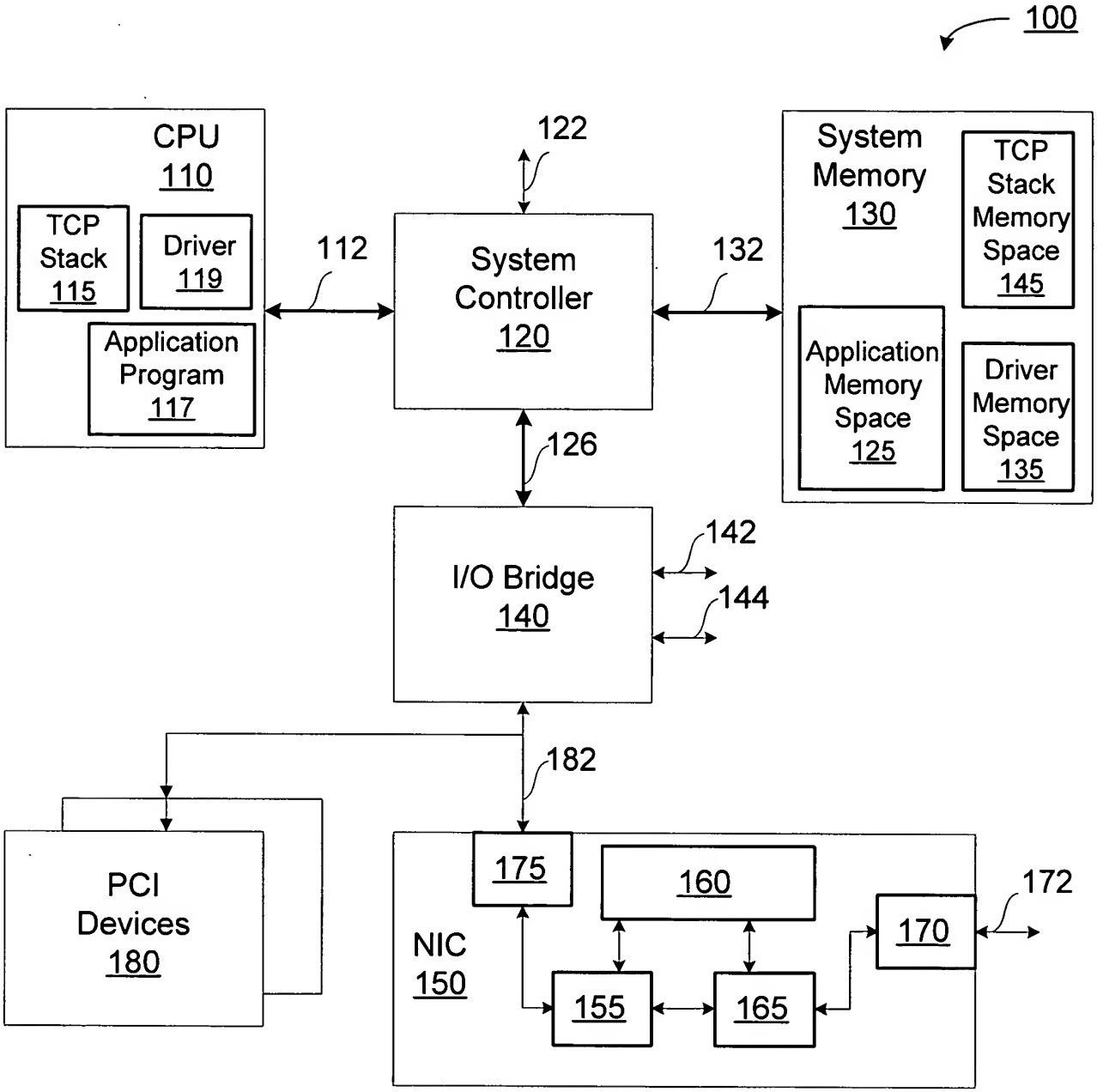


Fig. 1

PRIOR ART

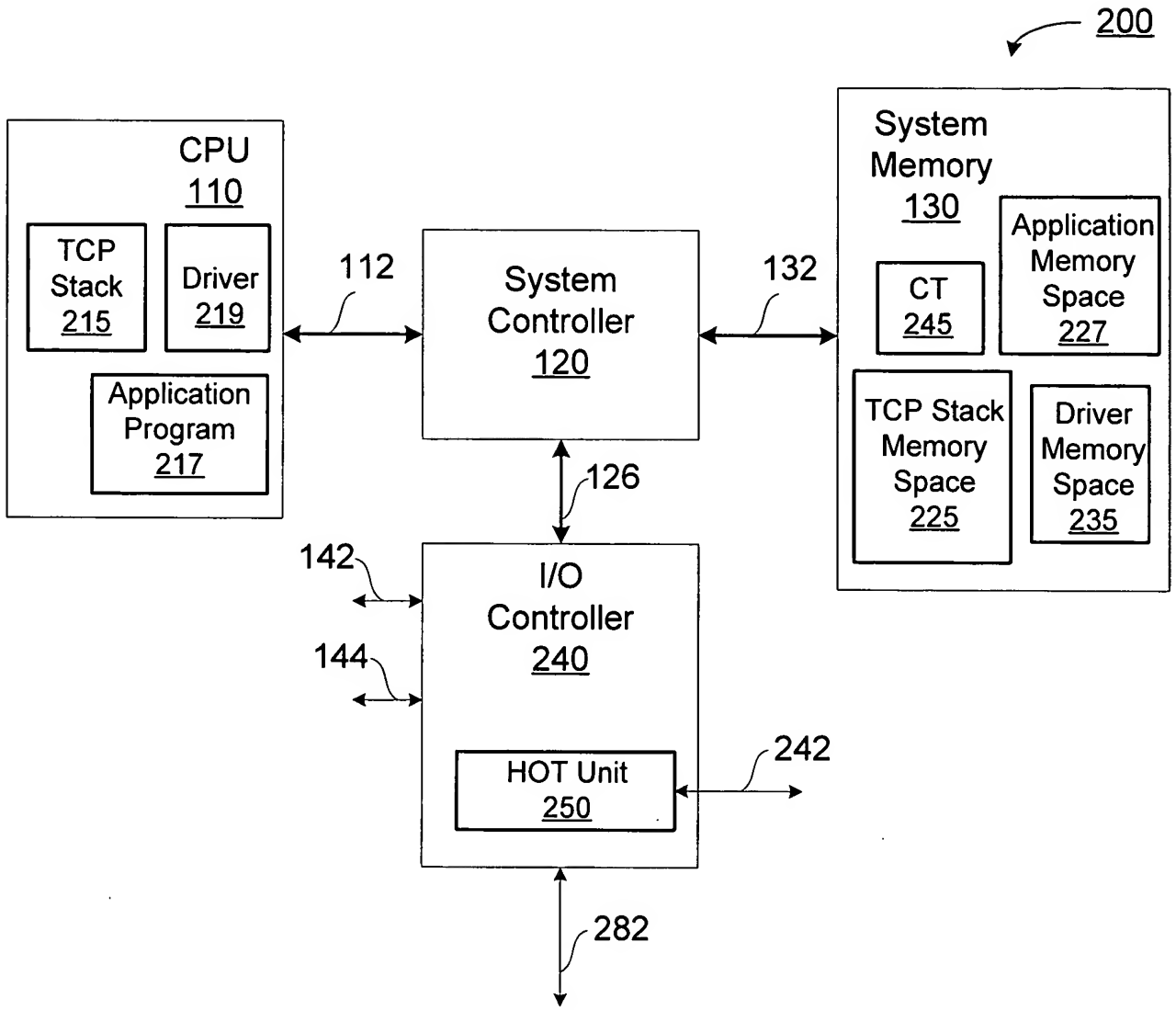

200
CPU
110
TCP
Stack
215
Driver
219
Application
Program
217
112
System
Controller
120
132
System
Memory
130
CT
245
Application
Memory
Space
227
TCP Stack
Memory
Space
225
Driver
Memory
Space
235
126
142
144
I/O
Controller
240
HOT Unit
250
242
282

Fig. 2A

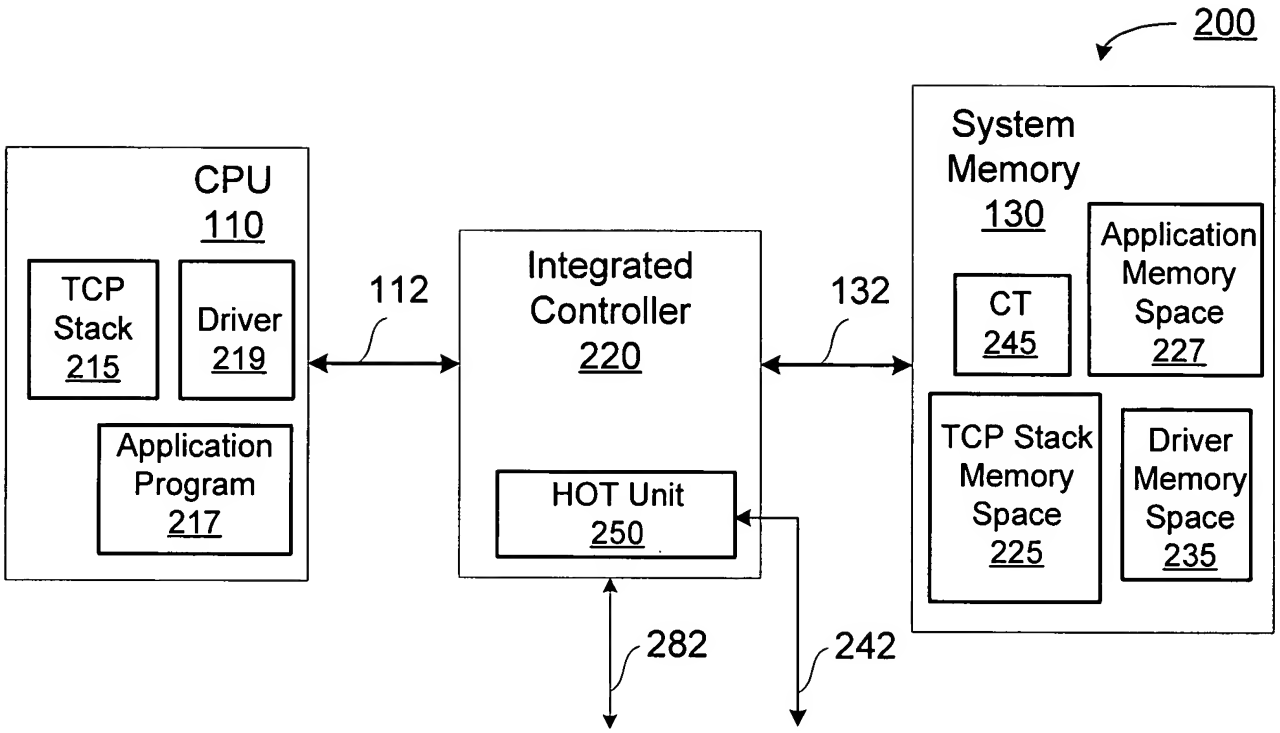

200
CPU
110
TCP
Stack
215
Driver
219
Application
Program
217
112
Integrated
Controller
220
HOT Unit
250
132
System
Memory
130
CT
245
Application
Memory
Space
227
TCP Stack
Memory
Space
225
Driver
Memory
Space
235
282
242

Fig. 2B

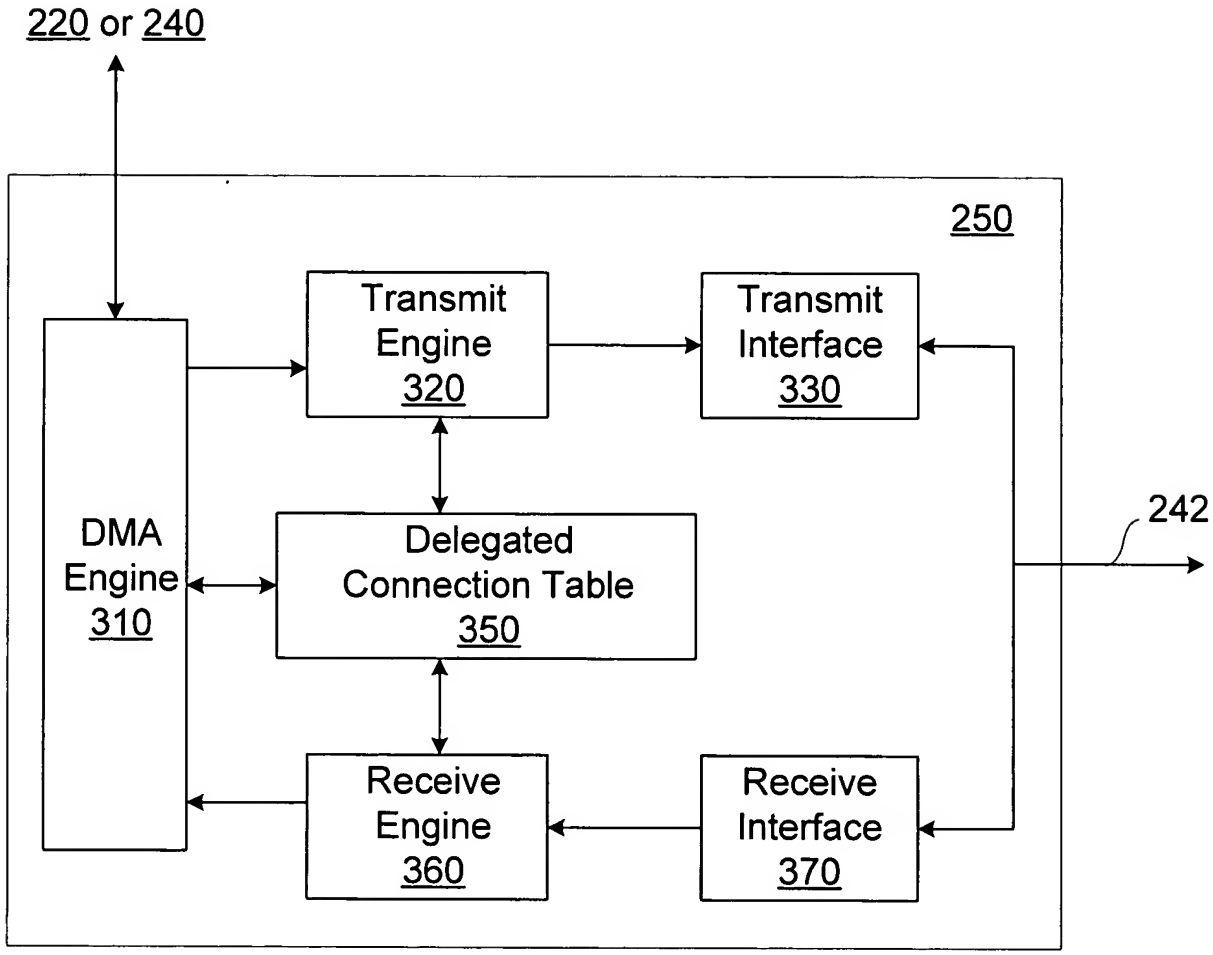

220 or 240
250
Transmit Engine 320
Transmit Interface 330
DMA Engine 310
Delegated Connection Table 350
242
Receive Engine 360
Receive Interface 370

Fig. 3

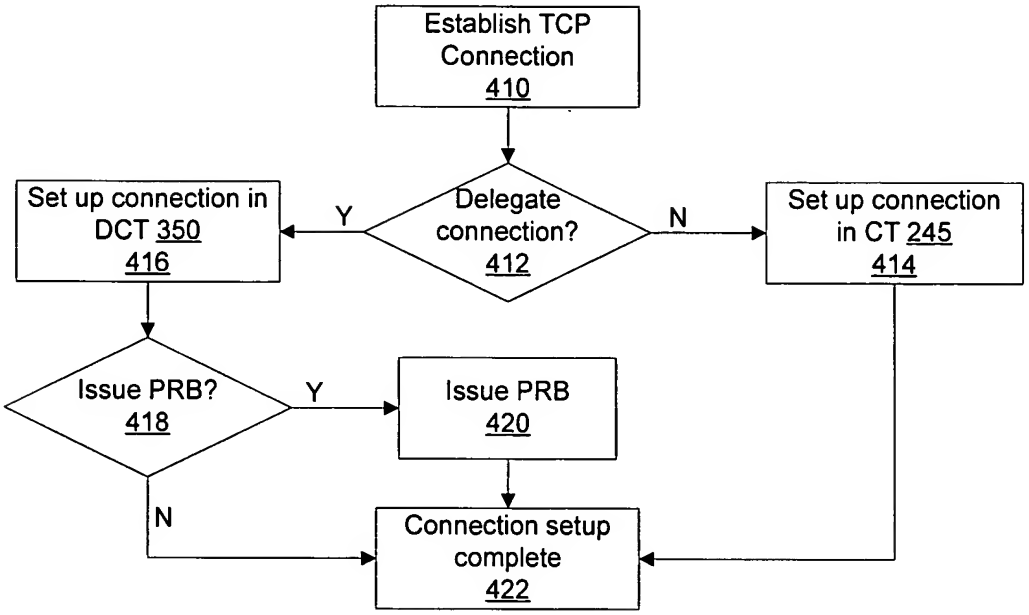

Establish TCP Connection 410
Delegate connection? 412
Y
N
Set up connection in DCT 350 416
Set up connection in CT 245 414
Issue PRB? 418
Y
Issue PRB 420
N
Connection setup complete 422

Fig. 4A

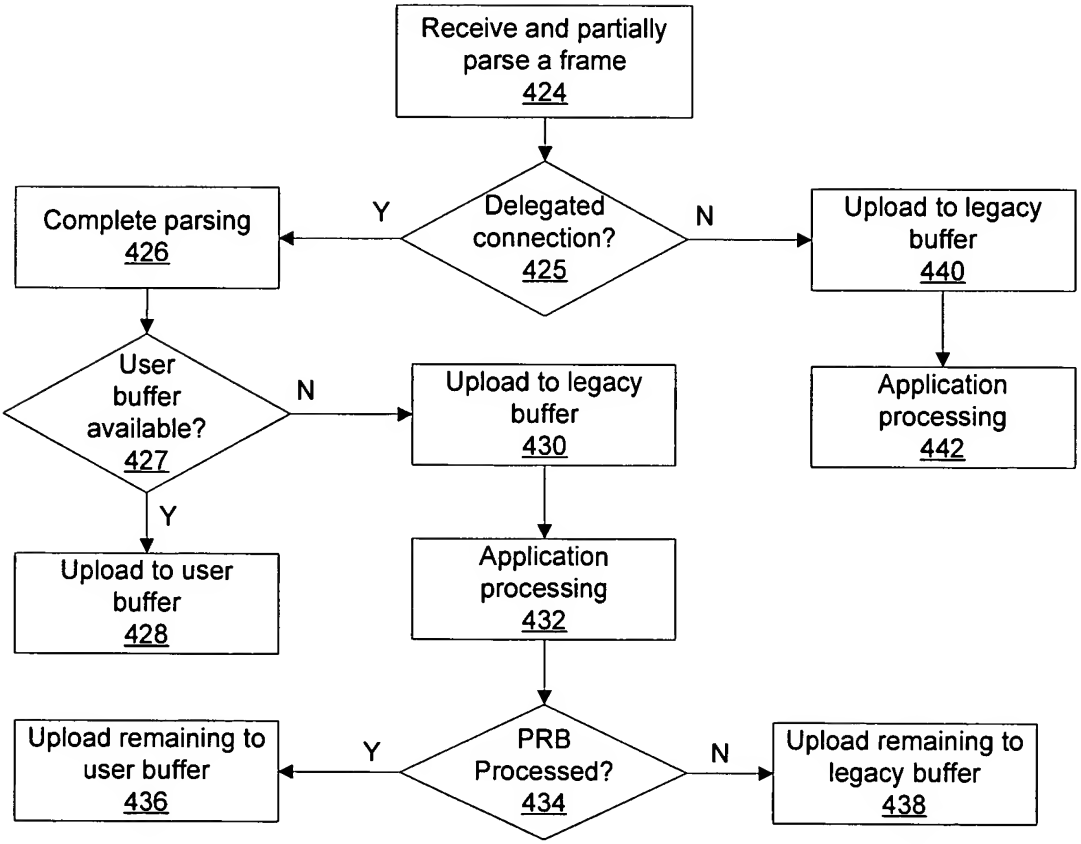

Receive and partially parse a frame 424
Delegated connection? 425
Y
N
Complete parsing 426
Upload to legacy buffer 440
User buffer available? 427
N
Upload to legacy buffer 430
Application processing 442
Y
Upload to user buffer 428
Application processing 432
PRB Processed? 434
Y
N
Upload remaining to user buffer 436
Upload remaining to legacy buffer 438

Fig. 4B

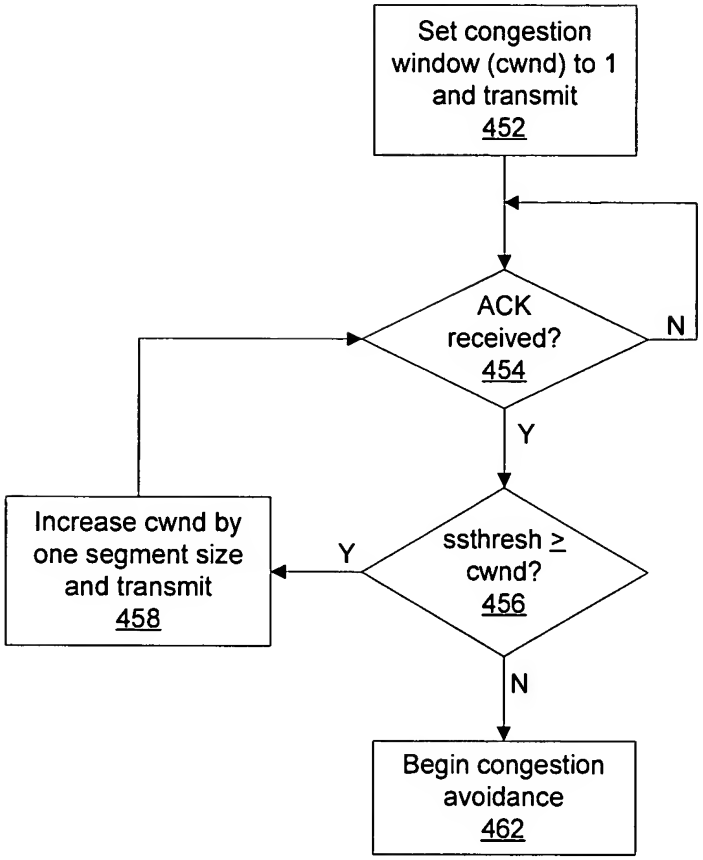

Set congestion window (cwnd) to 1 and transmit
452
ACK received?
454
N
Y
ssthresh ≥ cwnd?
456
Y
Increase cwnd by one segment size and transmit
458
N
Begin congestion avoidance
462

Fig. 4C

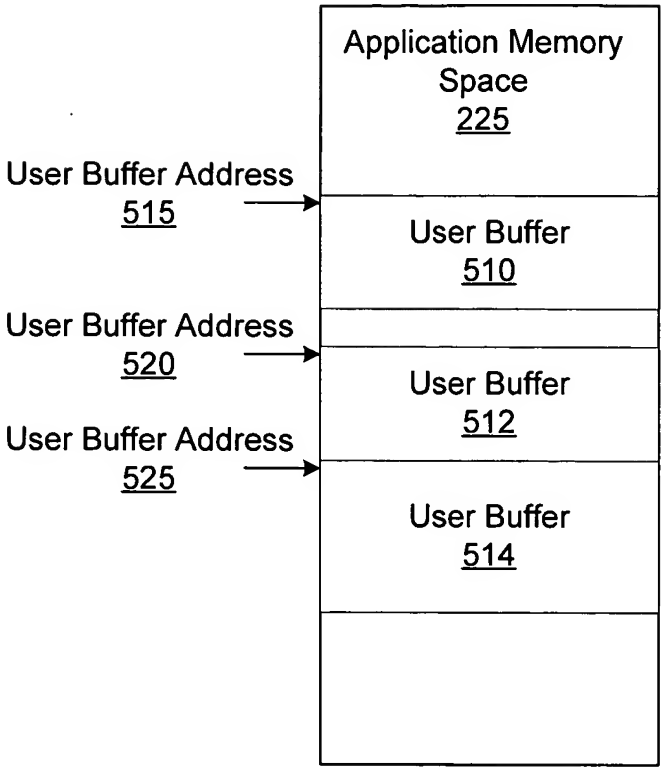

Application Memory Space
225
User Buffer Address
515
User Buffer
510
User Buffer Address
520
User Buffer
512
User Buffer Address
525
User Buffer
514

Fig. 5A

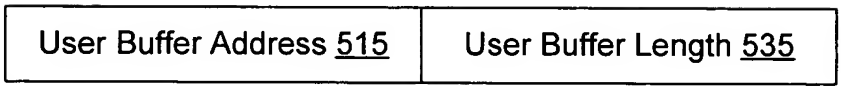

User Buffer Address 515
User Buffer Length 535

Fig. 5B

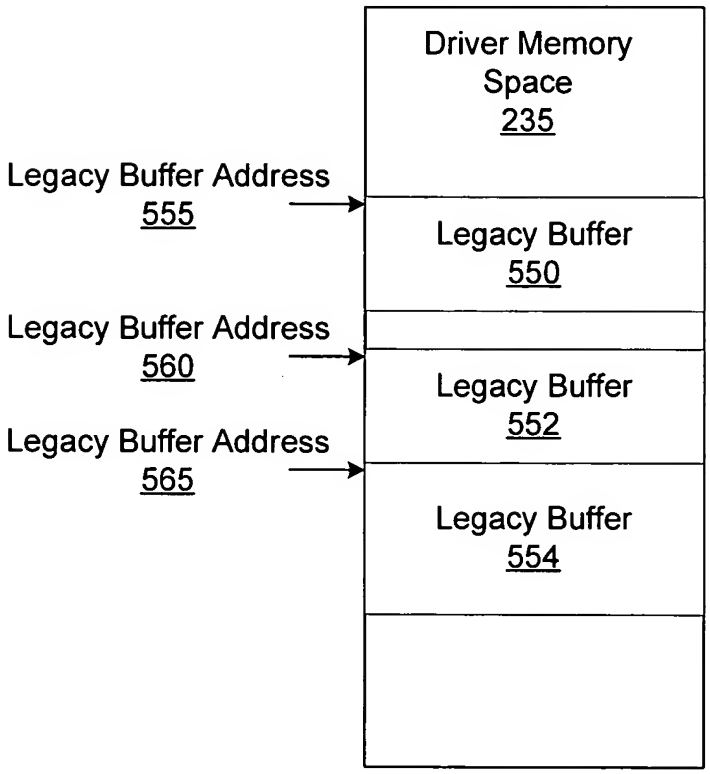


Fig. 5C

Legacy Buffer Tag Table 590

Tag 575	Legacy Buffer Address 555
Tag 580	Legacy Buffer Address 560
Tag 585	Legacy Buffer Address 565

Fig. 5D

Legacy Buffer Address 555	Legacy Buffer Length 570	Tag 575

Fig. 5E

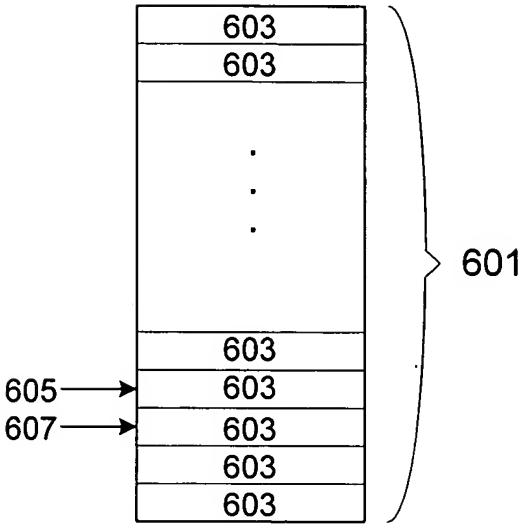


Fig. 6A

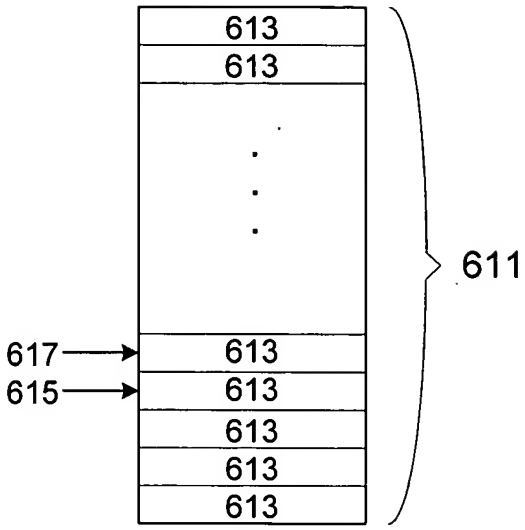


Fig. 6B

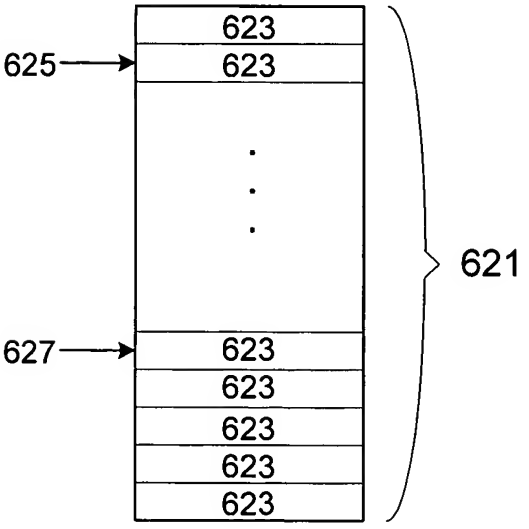


Fig. 6C

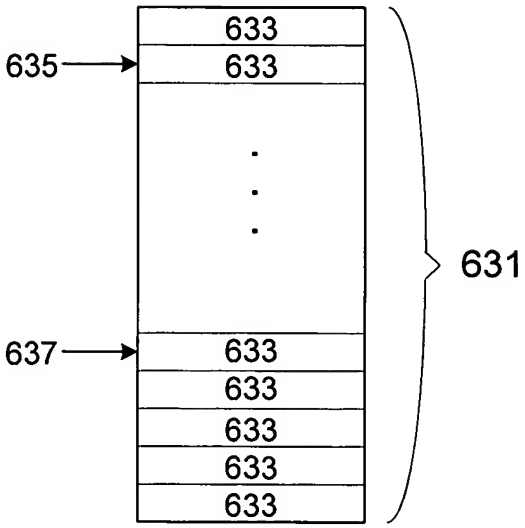


Fig. 6D

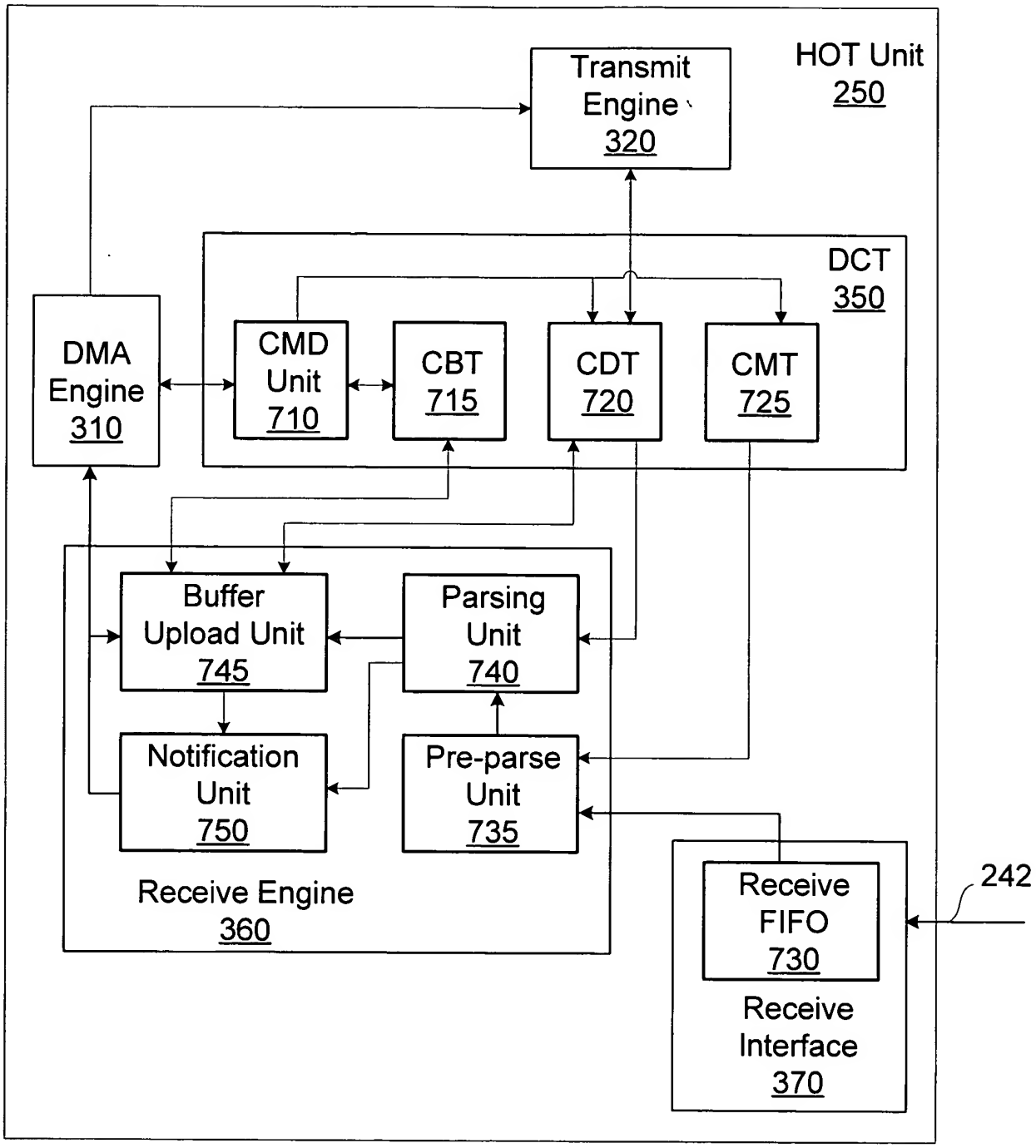

HOT Unit
250
Transmit Engine
320
DCT
350
DMA Engine
310
CMD Unit
710
CBT
715
CDT
720
CMT
725
Buffer Upload Unit
745
Parsing Unit
740
Notification Unit
750
Pre-parse Unit
735
Receive Engine
360
Receive FIFO
730
Receive Interface
370
242

Fig. 7

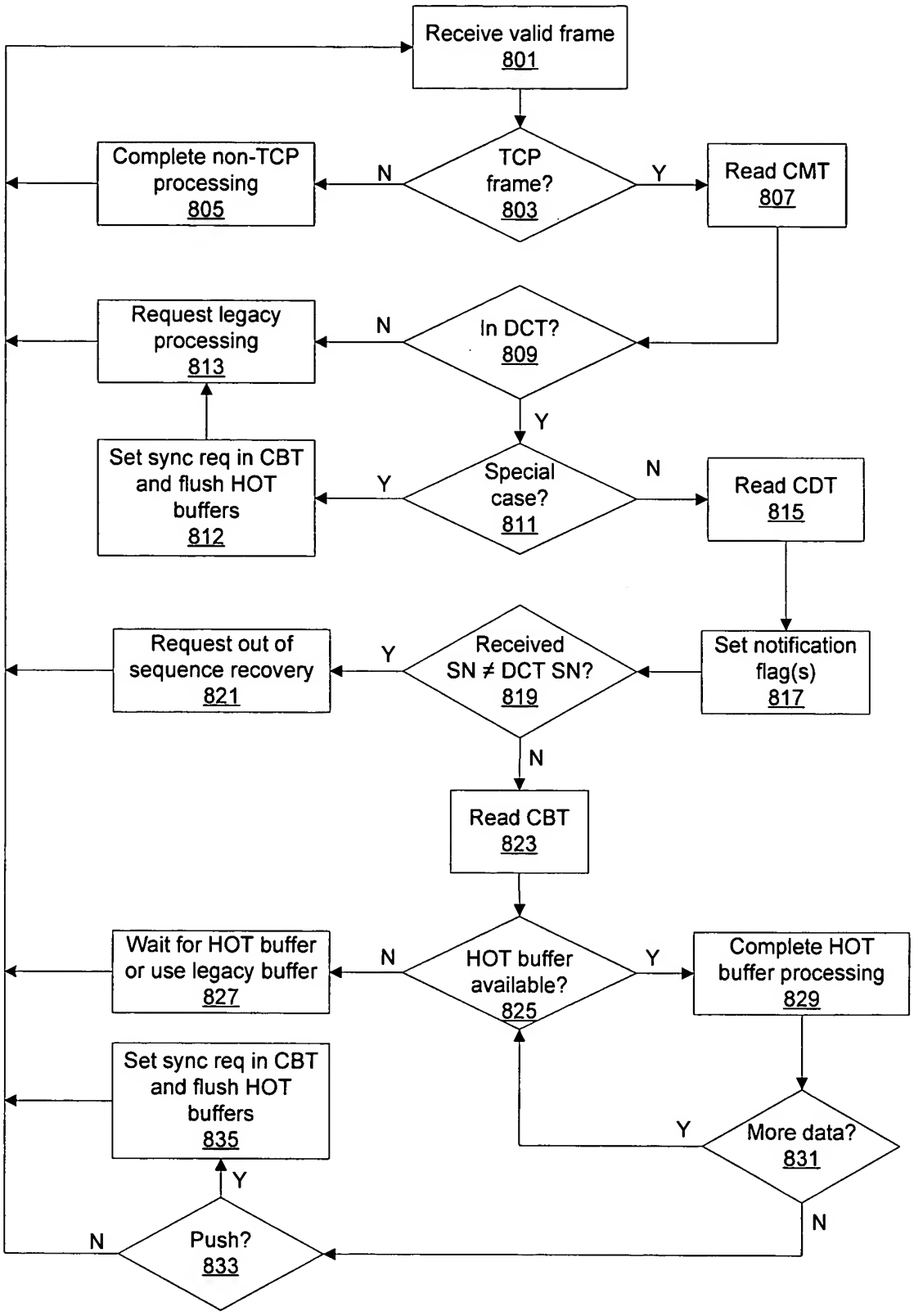

Receive valid frame
801
TCP frame?
803
N
Y
Complete non-TCP processing
805
Read CMT
807
In DCT?
809
N
Y
Request legacy processing
813
Special case?
811
Y
N
Set sync req in CBT and flush HOT buffers
812
Read CDT
815
Received SN ≠ DCT SN?
819
Y
N
Request out of sequence recovery
821
Set notification flag(s)
817
Read CBT
823
HOT buffer available?
825
N
Y
Wait for HOT buffer or use legacy buffer
827
Complete HOT buffer processing
829
More data?
831
Y
N
Set sync req in CBT and flush HOT buffers
835
Push?
833
Y
N

Fig. 8A

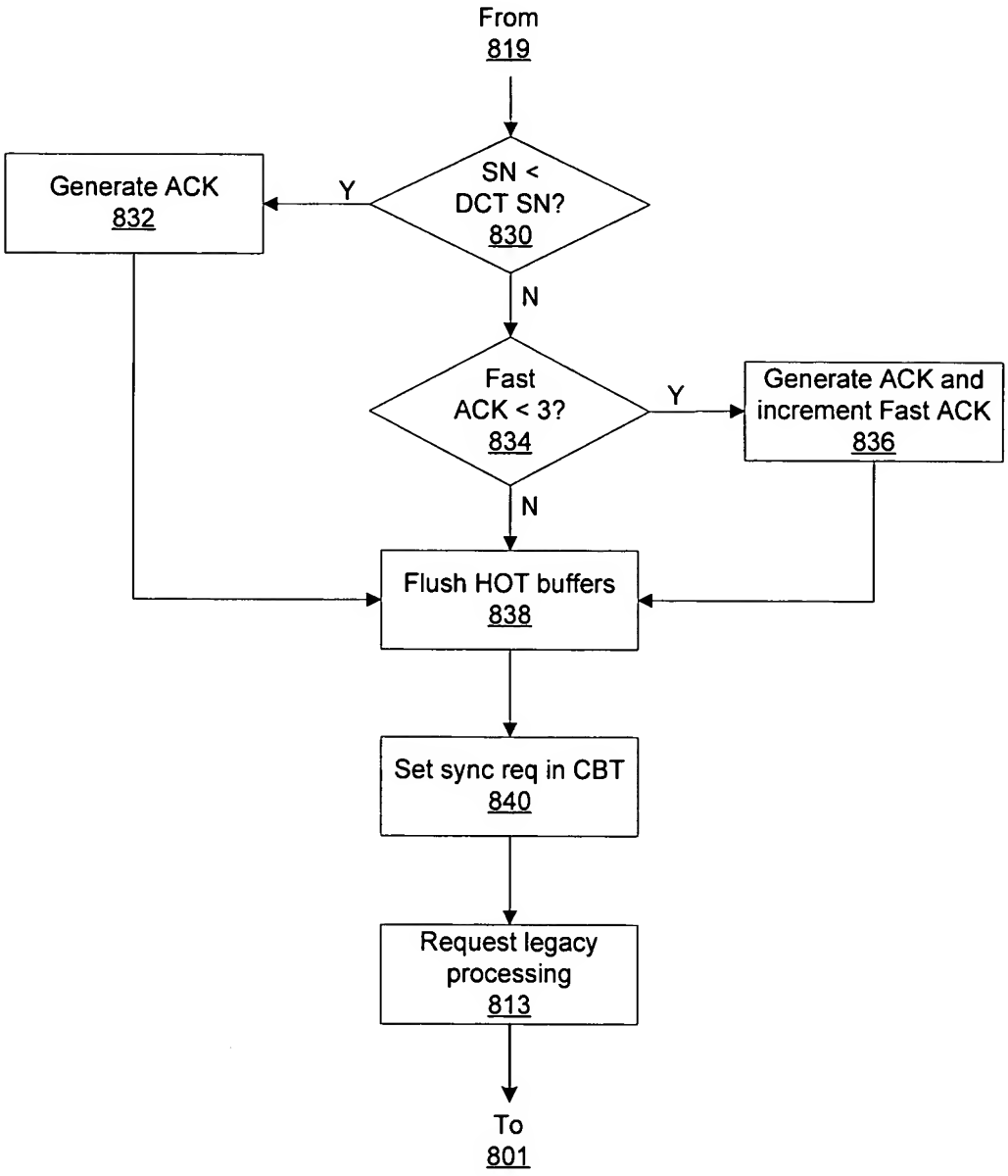

From
819
SN <
DCT SN?
830
Y
Generate ACK
832
N
Fast
ACK < 3?
834
Y
Generate ACK and
increment Fast ACK
836
N
Flush HOT buffers
838
Set sync req in CBT
840
Request legacy
processing
813
To
801

Fig. 8B

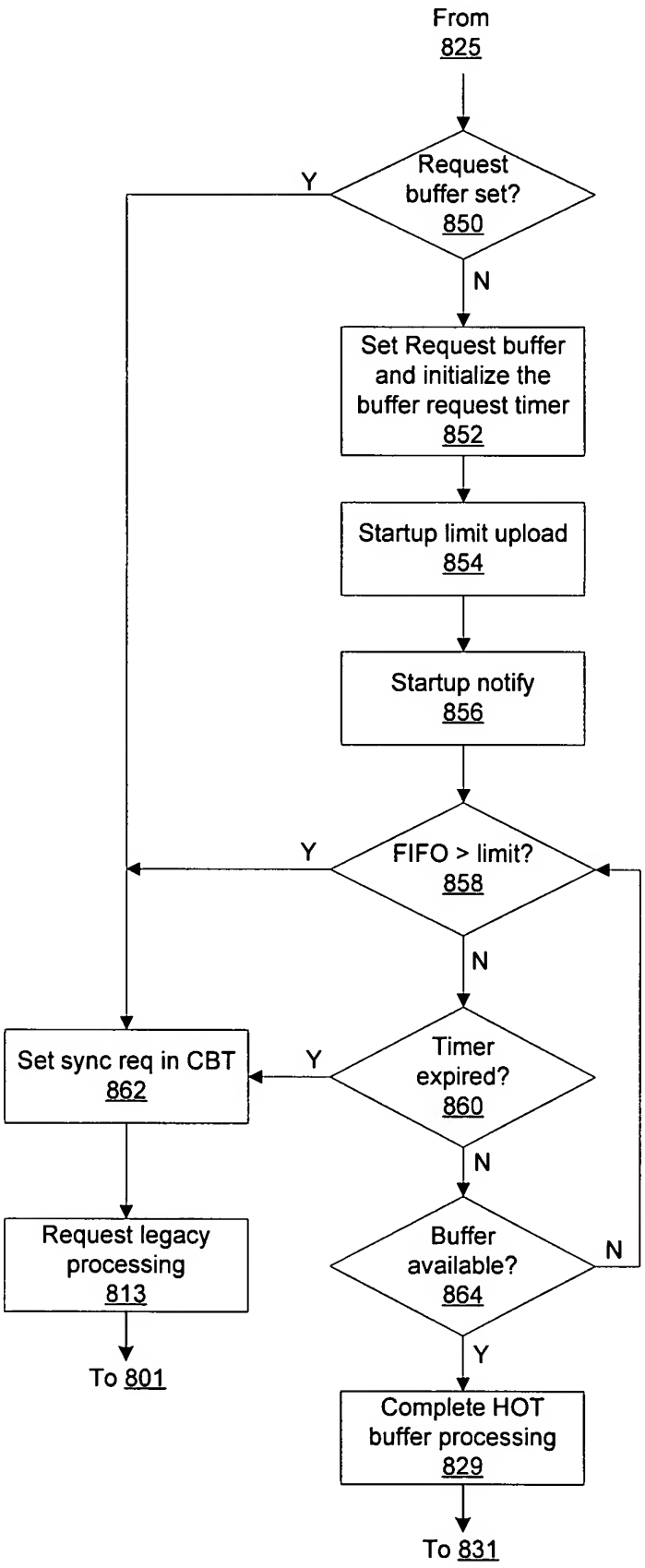

From
825
Request buffer set?
850
Y
N
Set Request buffer and initialize the buffer request timer
852
Startup limit upload
854
Startup notify
856
FIFO > limit?
858
Y
N
Timer expired?
860
Y
N
Buffer available?
864
N
Y
Set sync req in CBT
862
Request legacy processing
813
To 801
Complete HOT buffer processing
829
To 831

Fig. 8C

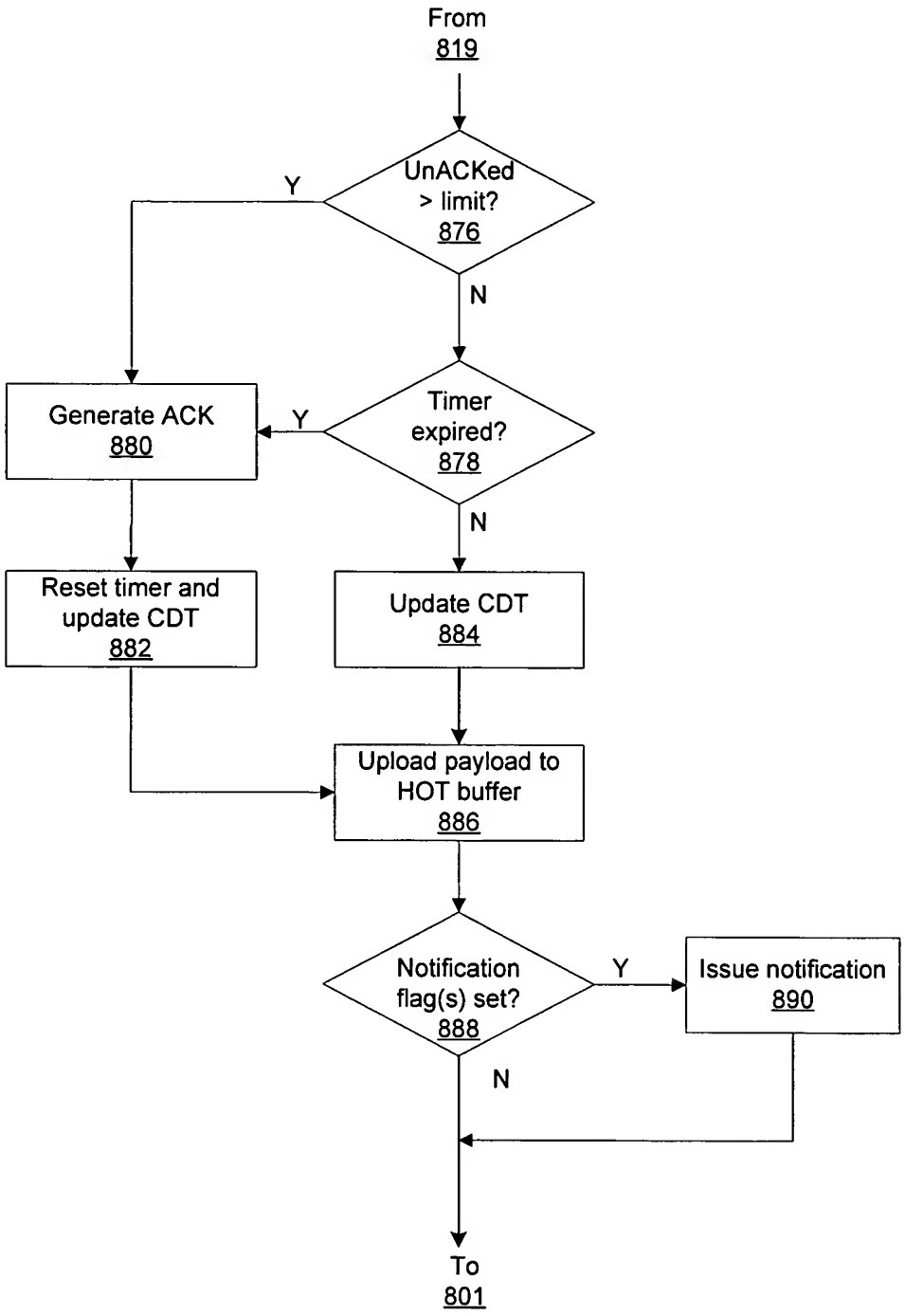

From
819
UnACKed
> limit?
876
Y
N
Timer
expired?
878
Y
Generate ACK
880
N
Reset timer and
update CDT
882
Update CDT
884
Upload payload to
HOT buffer
886
Notification
flag(s) set?
888
Y
Issue notification
890
N
To
801

Fig. 8D

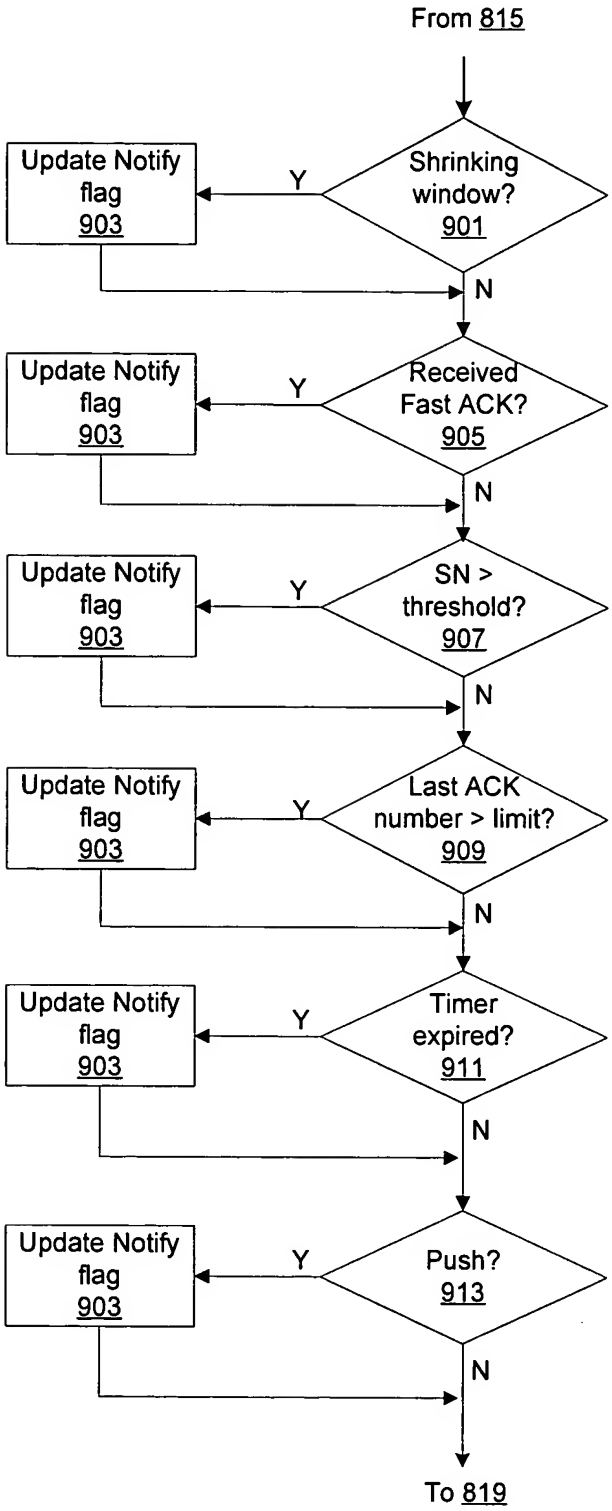

From 815
Shrinking window? 901
Y
Update Notify flag 903
N
Received Fast ACK? 905
Y
Update Notify flag 903
N
SN > threshold? 907
Y
Update Notify flag 903
N
Last ACK number > limit? 909
Y
Update Notify flag 903
N
Timer expired? 911
Y
Update Notify flag 903
N
Push? 913
Y
Update Notify flag 903
N
To 819

Fig. 9A

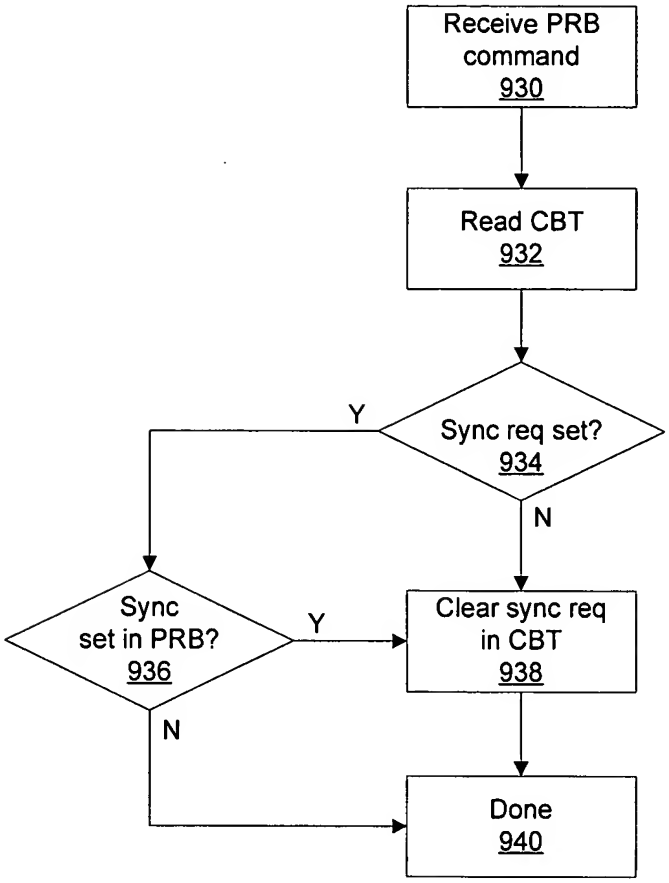

Receive PRB command 930
Read CBT 932
Sync req set? 934
Y
N
Sync set in PRB? 936
Y
N
Clear sync req in CBT 938
Done 940

Fig. 9B

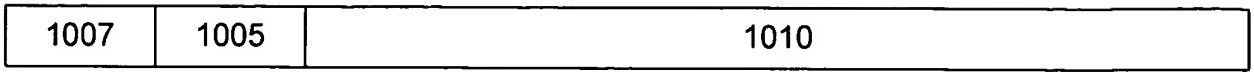
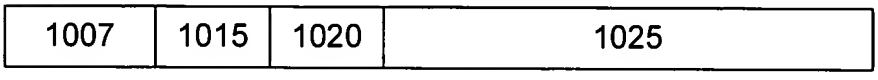


Fig. 10A



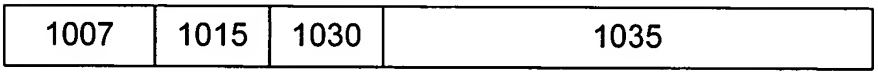


Fig. 10B

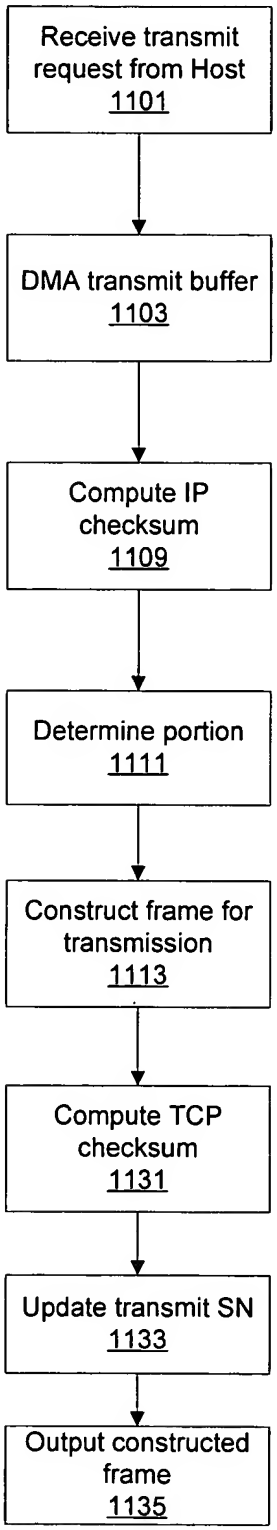

Receive transmit request from Host 1101
DMA transmit buffer 1103
Compute IP checksum 1109
Determine portion 1111
Construct frame for transmission 1113
Compute TCP checksum 1131
Update transmit SN 1133
Output constructed frame 1135

Fig. 11A

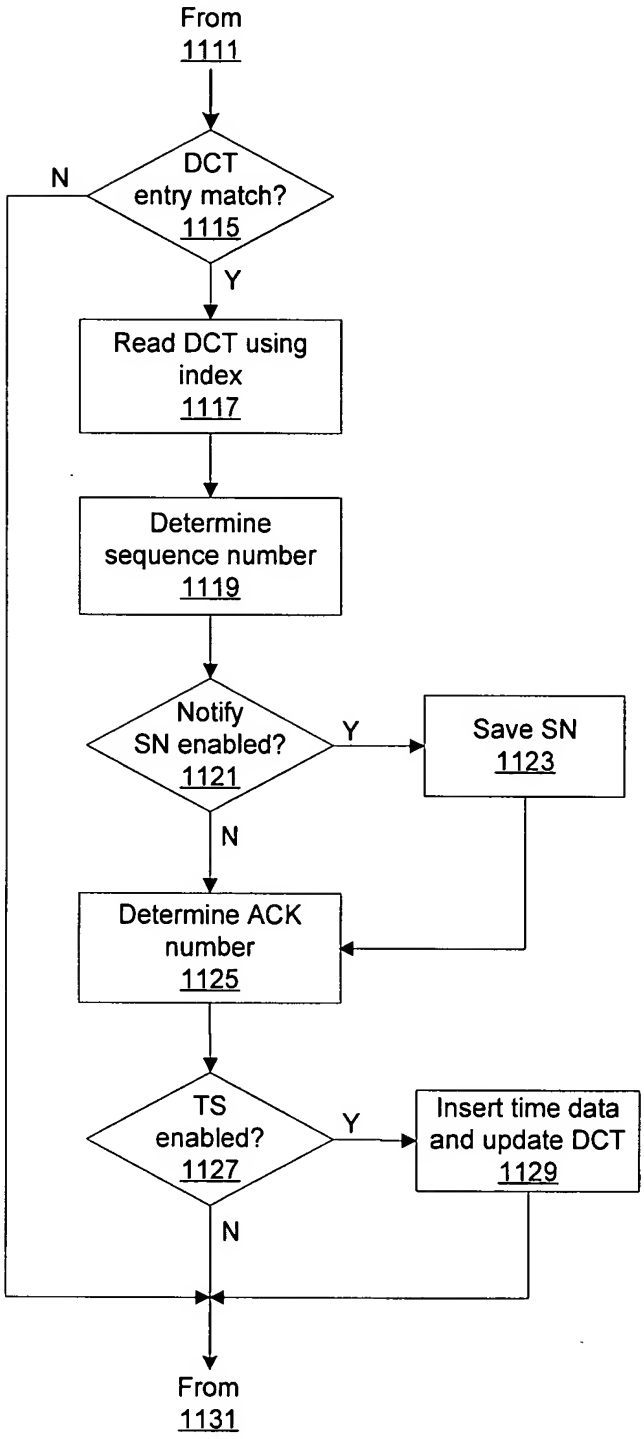

From
1111
DCT
entry match?
1115
N
Y
Read DCT using
index
1117
Determine
sequence number
1119
Notify
SN enabled?
1121
Y
Save SN
1123
N
Determine ACK
number
1125
TS
enabled?
1127
Y
Insert time data
and update DCT
1129
N
From
1131

Fig. 11B

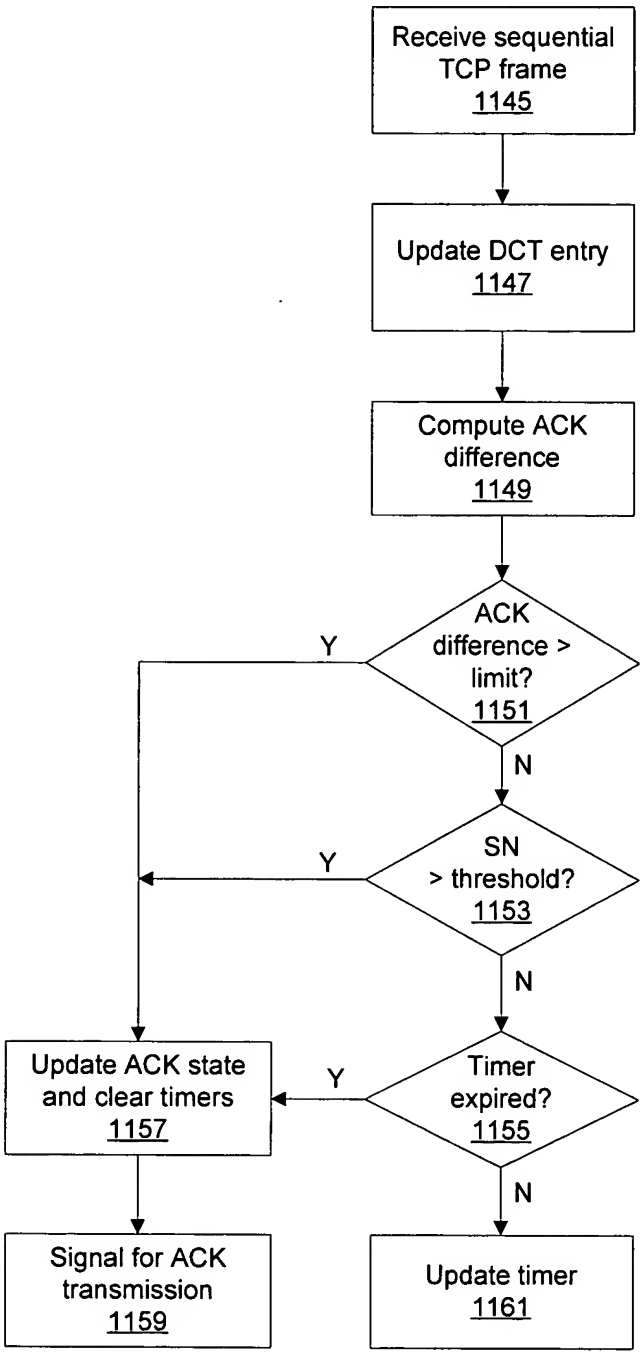

Receive sequential TCP frame 1145
Update DCT entry 1147
Compute ACK difference 1149
ACK difference > limit? 1151
Y
N
SN > threshold? 1153
Y
N
Timer expired? 1155
Y
N
Update ACK state and clear timers 1157
Signal for ACK transmission 1159
Update timer 1161

Fig. 11C